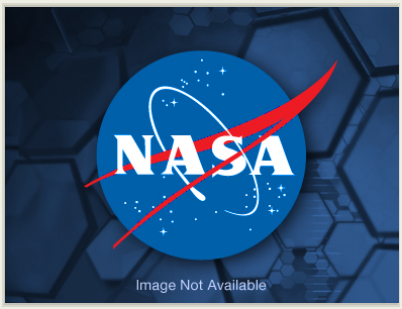
Reflective Spatial Heterodyne Spectrometers for high-resolving-power emission-line characterization from orbital and remote missions.

Completed Technology Project (2017 - 2019)

Project Introduction

High-resolution spectroscopy is an important tool for remote sensing of energetic, Doppler, and radiative transfer phenomena in the solar system. However, the technical constraints on the most common spectroscopic instrument designs (e.g. Echelle spectrometers) have limited our ability to deliver high resolving power capabilities to solar system targets via remote probes. This limitation is particularly acute at short wavelengths where the spectrum of solar system targets is dominated by emission lines free from contamination by solar continuum and where high resolving power would be especially effective. We propose here to continue development of the reflective spatial heterodyne spectrometer (SHS), an instrumental technique that combines high resolving power with exceptional sensitivity in a compact volume that enables their use in remote probes. SHS is a common-path Fourier transform spectrometer that achieves high sensitivity with a large intrinsic field of view that makes it well suited for orbital and flyby observations of planetary/satellite atmospheres, magnetospheric plasmas, and comets comae. We have constructed 3 demonstration prototypes of reflective SHS instruments under NASA support that have been used successfully at ground based facilities and on a sounding rocket to observe water group emissions from H, O, and OH within narrow bandpasses that collectively cover the wavelength range from 120 to 630 nm. As part of this program we would advance these laboratory instruments from their current TRLs of 3-5. This will be achieved through improved mechanical designs emphasizing thermal tolerance and stability under flight stress in a smaller format, development of automated alignment capabilities, incorporation of an EMCCD photon counting detector system, and enhancement of wavelength coverage through the use of multi-order gratings.



Reflective Spatial Heterodyne Spectrometers for high-resolving-power emission-line characterization from orbital and remote missions.

Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

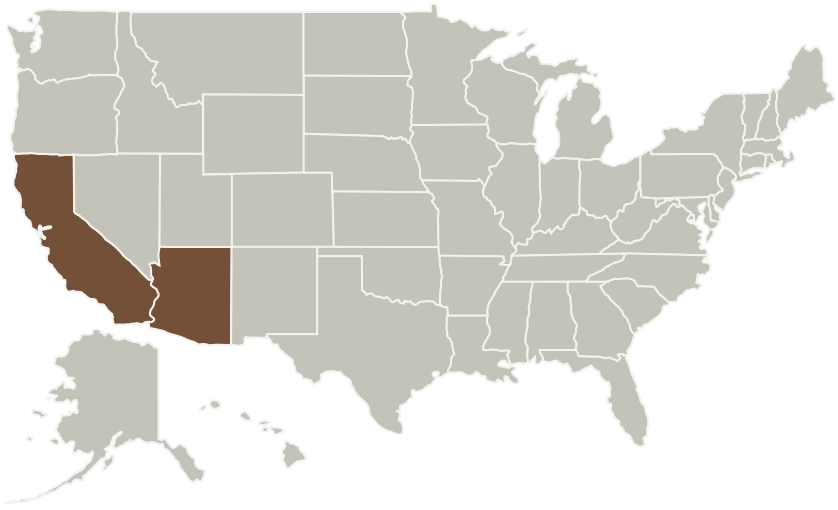
Responsible Program:

Maturation of Instruments for Solar System Exploration

Reflective Spatial Heterodyne Spectrometers for high-resolving-power emission-line characterization from orbital and remote missions.

Completed Technology Project (2017 - 2019)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
University of Arizona	Supporting Organization	Academia Alaska Native and Native Hawaiian Serving Institutions (ANNH), Hispanic Serving Institutions (HSI)	Tucson, Arizona

Primary U.S. Work Locations	
Arizona	California

Project Management

Program Director:

Carolyn R Mercer

Program Manager:

Haris Riris

Principal Investigator:

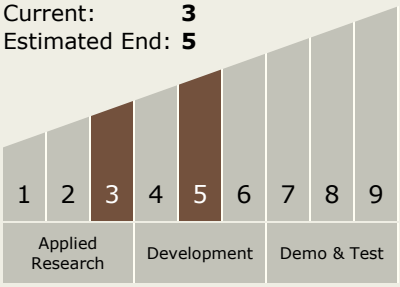
Walter M Harris

Co-Investigators:

Tyler Roberts
Jason B Corliss
Shouleh Nikzad

Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **5**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Reflective Spatial Heterodyne Spectrometers for high-resolving-power emission-line characterization from orbital and remote missions.

Completed Technology Project (2017 - 2019)

Target Destination

Others Inside the Solar System